

48KHA,KLA

Packaged Heating/Cooling Units

Installation, Start-Up and Service Instructions

NOTE TO INSTALLER: After installation, leave these instructions, Owner's Manual and Parts Replacement Guide with equipment owner.



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SAFETY CONSIDERATIONS

⚠ WARNING

Improper installation, adjustment, alteration, service, maintenance or use can cause carbon monoxide poisoning, explosion, fire, electric shock or other occurrences which may injure you or damage your property. Consult a qualified installer, service agency or the gas supplier for information or assistance.

NOTE: Installation of this unit must conform to the guidelines presented in these Installation Instructions. Read and become familiar with this publication before starting installation.

Only trained, qualified installers and service mechanics should install, start-up and service this equipment. Consult the User's Manual for routine maintenance. All other operations should be performed by trained service personnel.

personnel.

- Follow all safety codes.
- Wear safety glasses and work gloves.
- Use care in handling, rigging and setting bulky equipment.
- Observe precautions in these instructions and on equipment tags, stickers and labels.

⚠ WARNING

Do not disconnect electric power to this appliance without first turning off gas supply. Be sure power to equipment is shut off before maintenance or service.

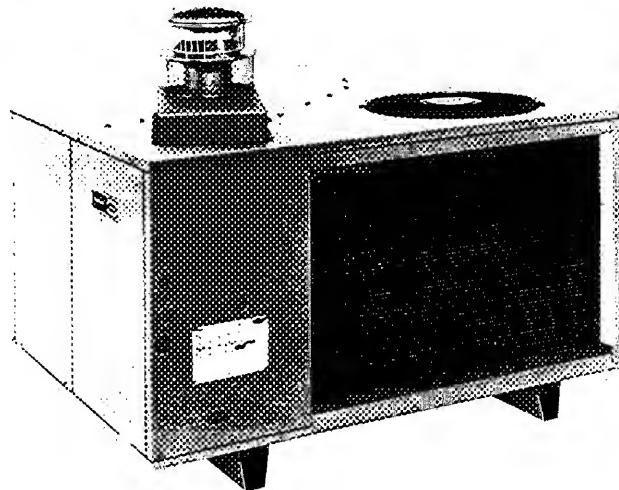


Fig. 1—Model 48KHA,KLA

GENERAL

Models 48KHA,KLA packaged gas/electric units (Fig. 1) are design certified in accordance with ANSI Z21.47B-1986, ARI Standard 210-81 and ARI Standard 270-84. The units are design certified by the American Gas Association (AGA) for use with natural or propane gases with appropriate controls or orifices. See Table 1 for heating input ratings. Models 48KHA,KLA units are fully self-contained, combination gas-heating/electric-cooling units designed for outdoor installation on either a rooftop or ground-level slab. May be installed directly on wood flooring or on Class A, Class B or Class C roof covering materials.

These units are equipped with an energy-saving automatic, intermittent, electric spark ignition system that does not have a continuously burning pilot. All units are manufactured with natural gas controls.

Units with number 1 in the 4th digit location of model number in Table 1 meet California oxides of nitrogen (NO_x) maximum emission requirements.

Units are factory charged with R-22 refrigerant. To install: connect gas supply, air ducts, high- and low-voltage wiring and condensate drain, and install a field-supplied air filter in the return-air ductwork.

Table 1—Performance Data

MODEL 48-	COOLING CAPACITY (Btuh)*	RATED HEATING INPUT (Btuh)	OUTPUT CAPACITY (Btuh)	ARI† SOUND RATING (BelS)
KLA118310BE	17,800	40,000	32,000	7.8
KLA124310BE	23,800	40,000	32,000	7.8
KHA024310BF	24,000	75,000	58,000	8.0
KLA130310BE	29,600	40,000	32,000	7.8
KHA030310BF	29,600	75,000	58,000	7.8
KLA136310BE	36,000	60,000	47,000	8.0
KLA136510CE	36,000	60,000	45,000	8.0
KLA136610CE	36,000	60,000	45,000	8.0
KHA136310BE	36,000	100,000	79,000	8.0
KHA136510CE	36,000	100,000	75,000	8.0
KHA036310BF	36,000	125,000	97,000	8.0
KHA036510CF	36,000	125,000	93,750	8.0
KLA142310BE	42,000	60,000	47,000	7.8
KLA142510CE	42,000	60,000	45,000	7.8
KHA042310BF	42,000	125,000	97,000	7.8
KHA042510CF	42,000	125,000	93,750	7.8
KLA148310BE	49,000	80,000	63,000	8.4†
KLA148510CE	49,000	80,000	60,000	8.4†
KLA148610CE	49,000	80,000	60,000	8.4†
KHA048310BE	49,000	125,000	97,000	8.4†
KHA048510CF	49,000	125,000	93,750	8.4†
KLA160310BE	60,000	100,000‡	79,000‡	8.4†
KHA060310BF	60,000	150,000‡	116,000‡	8.4†

*Rated in accordance with U.S. Government D.O.E. test procedures and/or ARI Standard 210-81.

†Sound rating per ARI 270-84.

‡The capacity ratings of single-phase units are in accordance with U.S. Government D.O.E. test procedures and/or AGA certification requirements. For 3-phase units, the efficiency rating is a product thermal efficiency rating determined under continuous operating conditions, independent of any installed system.

All units can be connected into existing duct systems *that are properly sized and designed to handle an airflow of 350 to 450 cfm per each 12,000 Btuh of rated cooling capacity*. See Table 8 for cooling and heating airflow requirements.

NOTE: When installing any accessory item, see Installation Instructions packaged with accessory.

IMPORTANT— READ BEFORE INSTALLING

1. This installation must conform with all applicable local and national codes.
2. Power supply (volts, hertz and phase) must correspond to that specified on unit rating plate.
3. Electrical supply provided by utility must be sufficient to handle load imposed by unit.
4. Refer to Fig. 4 for locations of gas inlet, electrical inlets, condensate drain, duct connections, and required clearances before setting unit in place.
5. Locate unit where vent cap will be a minimum of 4 ft from openable windows or doors.
6. Installation must conform with local building codes and with National Fuel Gas Code, NFPA 54-1984/ANSI Z223.1-1984.

IMPORTANT: On some models, the high-voltage ignition cable is not connected to the spark generator terminal on the control head/gas valve assembly when shipped from the factory. The cable is fastened to the manifold on these models. Push the boot toward center of the cable to expose the connector on the end of the cable. Attach the connector securely to the terminal on the end of the control head/gas valve assembly. Push the boot over connector to insulate the high-voltage connection.

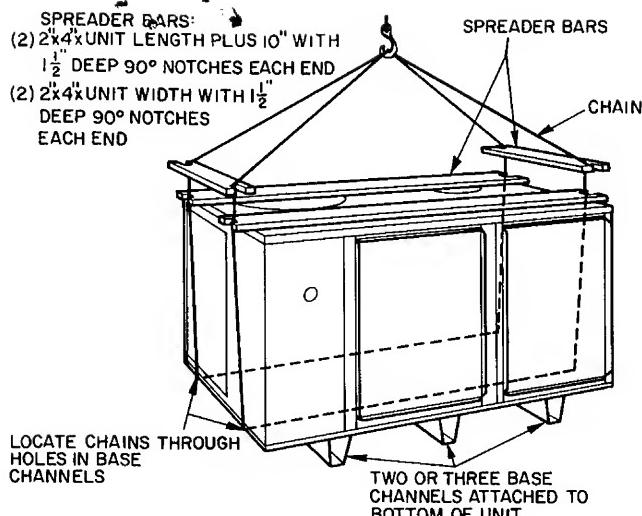


Fig. 2—48KHA,KLA Suggested Rigging

INSTALLATION

Step 1—Rig and Place Unit

! CAUTION

When rigging unit to be lifted, use spreader bars to protect top and sides. Rig unit as shown in Fig. 2. Use extreme caution to prevent damage when moving unit. Unit must remain in upright position during all rigging and moving operations. Unit must be level for proper condensate drainage; therefore, the ground-level pad or accessory roof-mounting curb must be level before setting unit in place. When a field-fabricated support is used, ensure that support is level and properly supports unit and plenum.

ROOFTOP INSTALLATION

! CAUTION

When installing a unit on a rooftop, be sure roof will support the additional weight. Refer to Fig. 4 to obtain total weight and corner weight information.

When installing a Model 48KHA, KLA end discharge unit with a field-supplied downflow plenum, a field-supplied roof-mounting curb must be installed on and flashed into roof before unit installation. When installing a Model 48KHA, KLA end discharge unit *without* a downflow plenum, place unit on a level base that provides proper support. On flat roofs be sure unit is located at least 4 in. above highest expected water level on roof to prevent flooding. Consult local codes for additional installation requirements.

GROUND LEVEL INSTALLATION—Place unit on a solid, level concrete pad that is a minimum of 4 in. thick and that extends approximately 2 in. beyond casing on all sides of unit. Do not secure unit to pad *except* when required by local codes.

CLEARANCES—Required minimum operating and service clearances are shown in Fig. 4 for providing adequate combustion, ventilation and condenser air.

! CAUTION

Do not restrict condenser airflow. An air restriction at either outdoor-air inlet (the entire surface of the outdoor coil) or fan discharge can be detrimental to compressor life.

Condenser fan discharges through top of unit. Ensure that fan discharge does not recirculate to condenser coil. Do not locate unit in either a corner or under a complete overhead obstruction. Minimum clearance under a partial overhang (such as a typical house roof overhang) is 3 ft above vent cap. Maximum horizontal extension of a partial overhang must not exceed 4 feet.

Do not locate unit where water, falling ice or snow from an overhang or roof will damage or flood the unit. Do not locate unit where grass, shrubs, or other plants will interfere with the airflow either into or out of unit. Do not install unit on carpeting, tile or other combustible material other than wood flooring.

CONDENSATE DISPOSAL

NOTE: Be sure condensate water disposal methods comply with local codes, restrictions and practices.

Models 48KHA, KLA dispose of condensate water through a $\frac{3}{4}$ -in. MPT drain fitting. See Fig. 4 for location.

Install a 3-in. trap at the drain fitting to ensure proper drainage. See Fig. 3. Make sure trap outlet is at least 2 in. lower than unit drain pan connection to prevent pan from overflowing. Prime trap with water.

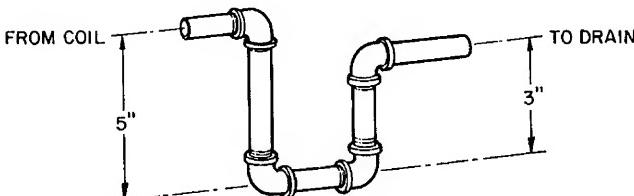


Fig. 3—Condensate Trap

If installation requires draining the condensate water away from unit, connect a drain tube using a minimum of $\frac{1}{2}$ -in. OD copper tubing, $\frac{3}{4}$ -in. galvanized pipe or $\frac{3}{4}$ -in. plastic pipe. *Do not undersize the tube.* Pitch drain tube downward at a slope at least one in. for every 10 ft of horizontal run. Be sure to check drain tube for leaks.

Condensate water can be drained directly onto roof in rooftop installations (where permitted) or onto a gravel apron in ground level installations. When using a gravel apron, make sure it slopes away from the unit.

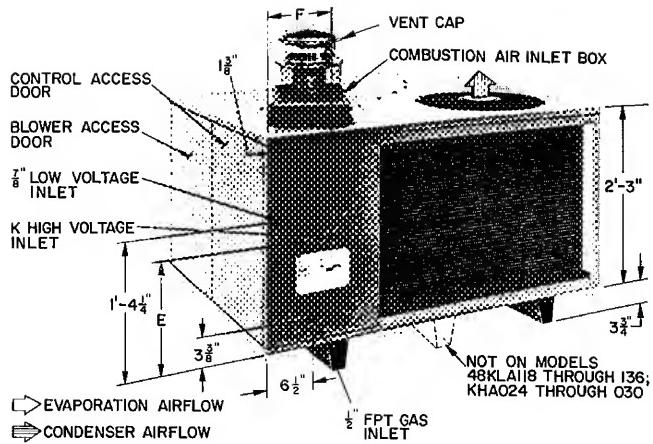
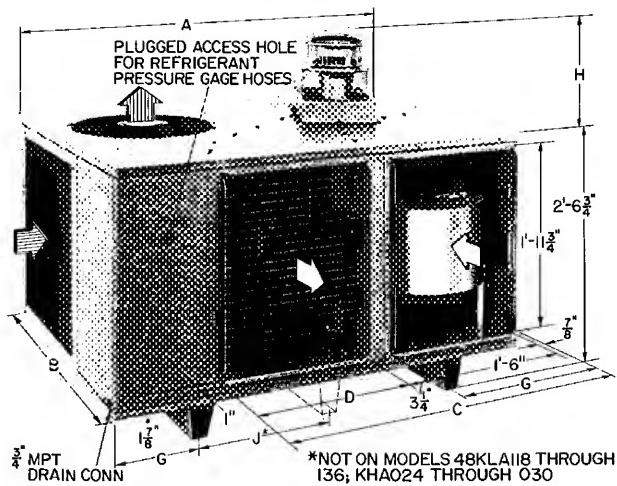
VENTING—The vent cap, combustion air shroud and flue assembly are shipped in either the blower or control compartment. Vent screen is taped to blower housing. Remove access doors to locate assemblies. See Fig. 4 for door locations.

! CAUTION

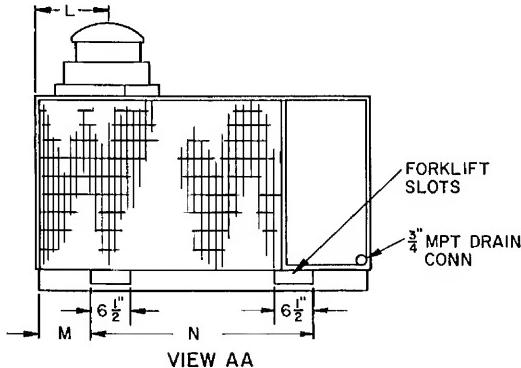
Venting system is designed to ensure proper venting. Vent cap assembly must be installed as indicated below.

NOTE: Screw holes in flue assembly and unit top are positioned to ensure proper orientation when installed. Refer to Fig. 5 and install vent cap as follows:

1. Place combustion air shroud over combustion air opening in unit top, and line up screw holes in shroud with holes in top. Secure shroud to top, using screws with rubber washers (provided).
2. The flue gasket is shipped in the literature envelope. Place gasket and flue assembly through hole in combustion air shroud, orient screw holes in base of flue assembly with holes in unit top, and secure gasket and flue assembly to unit top, using screws provided.
3. Form flat wire screen (provided) into circular shape around protruding lip of combustion-air shroud and bend wire ends through holes of screen mesh to secure screen in place. Make sure that no sharp edges are left exposed.
4. Place vent cap sleeve inside flue assembly. Orient spring clip of vent cap with slot in assembly. Be sure clip snaps into slot to secure clip onto assembly.



MODEL 48-	KLA118 KLA124	KHA024 KLA130 KHA030 KLA136	KHA136 KHA036 KLA142 KHA042	KLA148 KHA048 KLA160 KHA060
Dimensions (ft-in.)				
A	4-5 5/8	4-5 5/8	5-5 5/8	6-0 3/8
B	2-6 3/8	3-4 3/8	3-8 5/8	3-8 5/8
C	3-2 1/8	3-5 1/8	3-10 1/8	4-6 1/8
D	1-4	1-7	2-0	2-8
E	1-4	1-4	1-1 1/4	1-1 1/4
F	0-7 1/4	0-8 1/8	0-8 1/8	0-8 1/8
G	0-11 5/8	0-10 5/8	0-10 5/8	0-11 1/8
H	1-3 1/4	1-3 1/4	1-8 1/4	1-8 1/4
J	—	—	1-10 1 1/8	2-0 31/32
K	0-1 3/32	0-1 3/8	0-1 3/8	0-1 3/8
L	0-1 7/8	0-1 7/8	1-4	1-5
M	0-4 1/16	0-6 1/16	0-8 3/16	0-8 3/16
N	1-10	2-4	2-4	2-4



CLEARANCES (ft-in.)

Above flue vent	3-0
Duct side of unit	0-6
Side opposite ducts	2-6
Blower access panel side	2-6
Side opposite blower access panel	2-6
Bottom of unit	0

NOTE: Provision must be made for fresh ambient air to reach the outdoor coil without recirculation of the air from the outdoor fan discharge

Weight Data

MODEL 48-	CORNER WT (lb)				TOTAL OPERATING WT (lb)	TOTAL SHIPPING WT (lb)
	A	B	C	D		
KLA118	82	79	79	81	320	330
KLA124	83	81	79	82	325	335
KHA024	96	94	91	94	375	385
KLA130	97	93	90	92	372	382
KHA030	97	93	91	94	375	385
KLA136	98	97	92	93	380	390
KHA136	122	120	116	117	475	485
KHA036	122	120	116	117	475	485
KLA142	108	105	102	105	420	430
KHA042	113	111	107	109	440	450
KLA148	130	135	137	133	535	545
KHA048	134	139	144	138	555	565
KLA160	148	144	139	144	575	585
KHA060	155	151	148	151	605	615

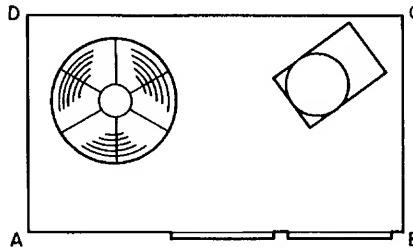


Fig. 4—Dimensions and Clearances (ft-in.)

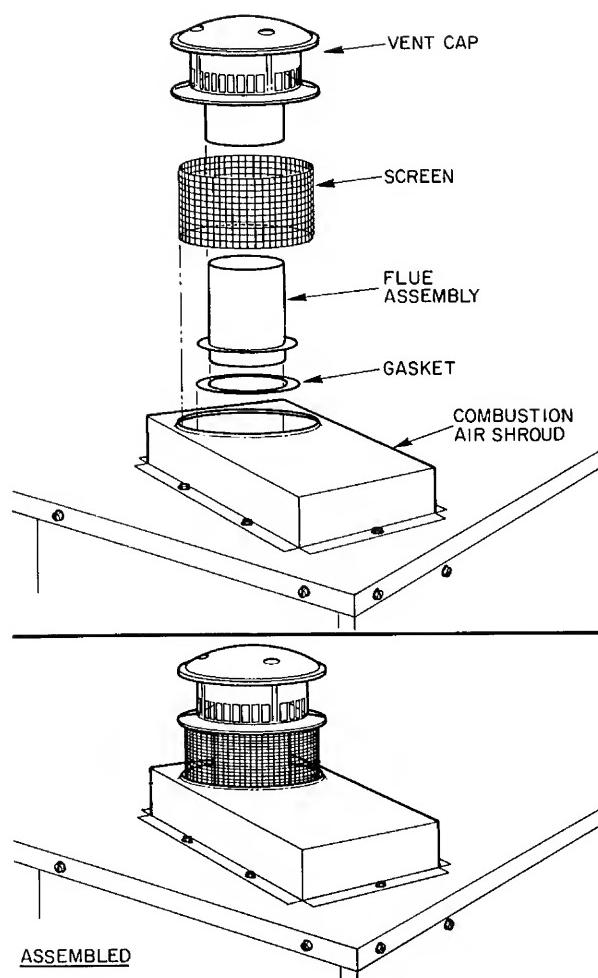


Fig. 5—Vent Cap Assembly

Step 2—Make Gas Piping Connections—A manual shutoff valve is shipped loose in the burner compartment or blower compartment. Connect one end of a field-supplied $\frac{1}{2}$ -in. straight nipple to the gas valve inlet. Connect the other end of the nipple to the manual shutoff valve as shown in Fig. 6. The gas supply pipe enters unit through access hole provided. See Fig. 4 for location. The gas connection to unit is made to the $\frac{1}{2}$ -in. FPT gas inlet on manual shutoff. See Fig. 6 for inlet location.

Install a separate gas supply line that runs directly from meter to heating section. *Do not use cast-iron pipe.* Check local utility for recommendations concerning existing lines. Choose a supply pipe that is large enough to keep pressure loss as low as practical. *Never use pipe smaller than the $\frac{1}{2}$ -in. FPT gas inlet on unit manual shutoff.*

When installing gas supply line, observe local codes pertaining to gas pipe installations. Refer to National Fuel Gas Code, NFPA 54-1984/ANSI Z223.1-1984 in absence of local building codes. Adhere to following pertinent recommendations:

1. Avoid low spots in long runs of pipe. Grade all pipe $\frac{1}{4}$ -in. in every 15 ft to prevent traps. Grade all horizontal runs downward to risers. Use risers to connect to heating section and to meter.

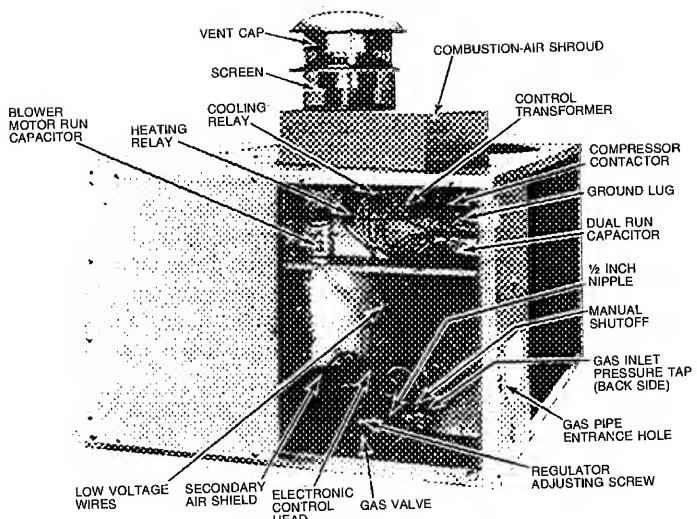


Fig. 6—Model 48KLA136—Side View (Partial) with Access Doors Removed

2. Protect all segments of piping system against physical and thermal damage. Support all piping with appropriate hangers, etc. Use a minimum of one hanger in every 6 feet. For pipe sizes larger than $\frac{1}{2}$ -in., follow recommendations of national codes.
3. Apply joint compound (pipe dope) sparingly and only to male threads of joint when making pipe connections. Use only pipe dope that is resistant to action of liquefied petroleum gases as specified by local and/or national codes. *Never use pipe thread tape.*
4. Install a sediment trap in riser leading to the heating section. See Fig. 7. This drip leg functions as a trap for dirt and condensate. Install trap where condensate cannot freeze. Install this sediment trap by connecting a piping tee to riser leading to heating section, so that straight-through section of tee is vertical. Then, connect capped nipple into lower end of tee. Extend capped nipple below level of gas controls.

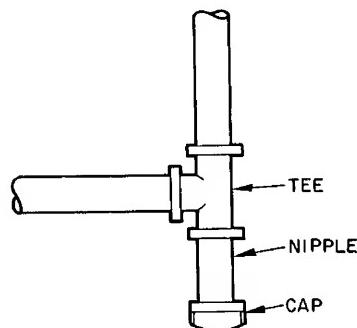


Fig. 7—Sediment Trap

5. Install an accessible, external, manual shutoff valve in gas supply pipe within 6 ft of heating section.
NOTE: The unit manual shutoff valve has a $\frac{1}{8}$ -in. tapping on the inlet side of this shutoff for measuring gas input pressure.
6. Install ground-joint union close to heating section between unit manual shutoff and external manual main shutoff valve.

7. Pressure-test all gas piping in accordance with local and national plumbing and gas codes before connecting piping to unit.

NOTE: When pressure-testing the gas supply system after the gas supply piping has been connected to the unit gas valve, the supply piping must be disconnected from the gas valve during any pressure testing of the piping systems at test pressures in excess of 0.5 in. psig. When pressure testing the gas supply piping system at test pressures equal to or less than 0.5 in. psig, the unit heating section must be isolated from the gas piping system by closing the external main manual shutoff valve and slightly opening ground-joint union.

⚠ CAUTION

Unstable operation may occur, particularly under high-wind conditions, when gas valve and manifold assembly are forced out of position while connecting improperly routed, rigid gas piping to gas valve. Use a backup wrench when making connection to avoid strain on, or distortion of, gas control piping.

8. Where permitted by local codes, use an approved corrugated metal tubing gas connector between rigid gas piping and unit manual shutoff.

⚠ WARNING

Never use a match or other open flame when checking for leaks. Failure to adhere to this warning may cause an explosion.

9. Check for gas leaks at all field-installed and factory-installed gas lines after all piping connections have been completed. Use soap-and-water solution (or method specified by local codes and/or regulations).

Step 3—Make Duct Connections—Model 48KHA,KLA has duct flanges on the supply- and return-air openings on side of unit. See Fig. 4 for connection sizes and locations.

⚠ WARNING

The design and installation of duct system must be in accordance with standards of National Fire Protection Association for installation of non-residence type air conditioning and ventilating systems. NFPA No. 90; or residence-type NFPA No. 90B; and/or local codes and ordinances.

Adhere to the following requirements when selecting, sizing and installing duct system:

1. Select and size ductwork, supply-air registers and return-air grilles according to ASHRAE recommendations and as presented in Carrier System Design Manual, Part 2.

⚠ CAUTION

When duct system fastening holes are drilled into side of Model 48KHA,KLA instead of the unit duct flanges, use extreme care to avoid puncturing coil or coil tubes.

2. Use a flexible transition between rigid ductwork and unit to prevent transmissions of vibration. The transition may be screwed or bolted to duct flanges. Use suitable gaskets to ensure a weathertight and air-tight seal.
3. Install external, field-supplied air filter(s) in return-air ductwork where it is easily accessible for service. Recommended filter sizes are shown in Table 2.
4. Size all ductwork for maximum required airflow (either heating or cooling) for unit being installed. Avoid abrupt duct size increases or decreases.
5. Adequately insulate and weatherproof all ductwork located outdoors. Insulate ducts passing through an unconditioned space, and use a vapor barrier in accordance with the latest issue of SMACNA and NESCA minimum installation standards for heating and air conditioning systems. Secure all ducts to building structure.
6. Flash, weatherproof and vibration-isolate all openings in building structure in accordance with local codes and good building practices.

**Table 2—Filter Sizes (Field Supplied),
(Sq In.)***

MODEL 48-	STANDARD DISPOSABLE TYPE	CLEANABLE OR HIGH CAPACITY TYPE
KLA118310BE	302	202
KHA024310BF	454	303
KLA124310BE	384	257
KHA030310BF	480	320
KLA130310BE	480	320
KHA036310BF	694	462
KHA136510CE	576	384
KHA036510CF	694	462
KHA136310BE	576	384
KLA136510CE	576	384
KLA136610CE	576	384
KLA136310BE	576	384
KHA042310BF	694	462
KHA042510CF	694	462
KLA142510CE	672	448
KLA142310BE	672	448
KHA048310BF	768	512
KHA048510CF	768	512
KLA148510CE	768	512
KLA148610CE	768	512
KLA148310BE	768	512
KHA060310BF	960	640
KLA160310BE	960	640

*Required air filter areas shown are based on the ARI-rated cooling airflow or the heating airflow at a velocity of 300 fpm depending on whichever value is larger. Air filter pressure drop should not exceed 0.08 in wg.

Step 4—Make Wiring Connections

⚠ WARNING

Unit cabinet must have an uninterrupted, unbroken electrical ground to minimize the possibility of personal injury if an electrical fault should occur. This ground may consist of electrical wire connected to unit ground lug in control compartment, or conduit approved for electrical ground when installed in accordance with National Electrical Code ANSI/NFPA 70-1984 and local electrical codes. *Do not use gas piping as an electrical ground.* Failure to follow this warning could result in the installer being held liable for personal injury of others.

▲ CAUTION

Failure to follow these precautions could result in damage to unit being installed.

1. Make all electrical connections in accordance with National Electrical Code ANSI/NFPA 70-1984 and local electrical codes governing such wiring.
2. Use only *copper* conductor for connections between the field-supplied electrical disconnect switch and the unit. *Do not use aluminum or copper-clad aluminum wire.*
3. Ensure that high-voltage power to unit is within operating voltage range indicated on unit rating plate. On 3-phase units, ensure that phases are balanced within 2%. Consult local power company for correction of improper voltage and/or phase balance.
4. When low-voltage control wires are run in same conduit as high-voltage wires, insulate low-voltage wires for highest voltage contained within conduit.
5. Do not damage internal components when drilling through any panel to mount electrical hardware, conduit, etc.

HIGH-VOLTAGE CONNECTIONS—Unit must have a separate electrical service with a field-supplied, waterproof, fused disconnect switch per NEC mounted near, and within sight from, the unit. Refer to unit rating plate for maximum fuse size and minimum circuit amps (ampacity) for wire sizing. Table 3 shows recommended wire sizes and lengths based on rating plate data.

The field-supplied disconnect switch box may be mounted on unit over the high-voltage inlet hole in control corner panel. See Fig. 4.

▲ WARNING

Label Part No. A74191B, which is shipped loose in bag of parts, *must be affixed* to the disconnect switch box. This label states: "DO NOT DISCONNECT THE ELECTRICAL POWER TO THIS APPLIANCE WITHOUT FIRST TURNING OFF THE GAS SUPPLY."

Proceed as follows to complete the high-voltage connections to unit:

1. Connect ground lead to chassis ground connection when using a separate ground wire.
2. Run high-voltage leads into unit control box and connect to contactor. See unit wiring label and Fig. 6 and 8.

NOTE: On 3-phase units, connect third high-voltage lead to brown high-voltage pigtail lead. See unit wiring label and Fig. 8.

SPECIAL PROCEDURES FOR 208-V OPERATION

▲ WARNING

Make sure power supply to unit is switched OFF before making any wiring changes. Electrical power may cause personal injury or death.

For operation on 208 volts, disconnect orange transformer-primary lead from contactor. See unit wiring label and Fig. 6. Remove tape and cover from terminal on end of red transformer-primary lead. Save cover. Connect red lead to contactor terminal from which orange lead was disconnected.

Using cover removed from red lead, insulate loose terminal on orange lead. Wrap cover with electrical tape so that metal terminal cannot be seen.

NOTE: For some 48KHA,KLA units, the factory-wired blower-motor speed connections may require changing for 208-v operation to ensure adequate airflow at the rated external static pressure. See unit wiring label. Insulate all unused motor leads following same procedures described for transformer leads.

LOW-VOLTAGE CONNECTIONS—Use a suitable room thermostat as specified on unit wiring label.

Locate room thermostat on an inside wall in space to be conditioned where it will not be subjected to either a cooling or heating source, or direct exposure to sunlight. Mount thermostat 4 to 5 ft above floor.

Use no. 18 AWG color-coded, insulated (35 C minimum) wires to make low-voltage connections between thermostat and unit. If thermostat is located more than 100 ft from unit (as measured along the low-voltage wires), use no. 16 AWG color-coded, insulated (35 C minimum) wires.

A grommeted, low-voltage inlet hole is located in the panel adjacent to control access panel. See Fig. 4. Run low-voltage leads from thermostat, through inlet hole and to low-voltage flagged pigtail leads that run through a hole in bottom of unit control box. See Fig. 6. Connect thermostat leads to pigtail leads as shown in Fig. 8.

HEAT ANTICIPATOR SETTING—Room thermostat heat anticipator must be properly adjusted to ensure proper heating performance. Set heat anticipator, using ammeter to determine exact required setting.

NOTE: For thermostat selection purposes, use 1.0 amps for approximate required setting.

Failure to make a proper heat anticipator adjustment will result in improper operation, discomfort to occupants of conditioned space and inefficient energy use; however, required setting may be changed slightly to provide a greater degree of comfort for a particular installation.

Table 3—Electrical Data (60 Hz)

MODEL 48-	SERIES	VOLTS- PHASE	OPERATING VOLTAGE*		COMPRESSOR		FLA		MCA†	MAX AMPS	MAX FUSE SIZE (Amps)‡	MIN WIRE SIZE (AWG)† (75C Copper)	MAX WIRE LENGTH†
			Min	Max	RLA	LRA	IFM	OFM					
KLA118	310BE	208/230-1	197	253	8.7	49.0	1.2	1.0	13.1	10.9	20	14	76
KLA124	310BE	208/230-1	197	253	11.7	63.0	1.7	1.0	17.4	14.4	25	12	89
KHA024	310BF	208/230-1	197	253	11.7	63.0	3.0	1.0	18.7	15.7	25	12	82
KLA130	310BE	208/230-1	197	253	13.7	76.0	3.1	1.0	21.2	17.8	30	10	115
KHA030	310BF	208/230-1	197	253	13.7	76.0	2.9	1.0	21.0	17.6	30	10	116
KLA136	310BE	208/230-1	197	253	17.6	88.0	4.6	1.0	27.6	23.2	40	10	88
KLA136	510CE	208/230-3	187	253	11.5	65.1	4.7	1.0	20.1	17.2	25	10	137
KLA136	610CE	460-3	414	506	5.1	32.8	1.9	0.6	8.9	7.6	15	14	272
KHA136	310BE	208/230-1	197	253	17.6	88.0	3.8	0.8	26.6	22.2	40	10	92
KHA036	310BF	208/230-1	197	253	11.5	65.1	5.6	1.0	21.0	18.1	25	10	130
KLA142	310BE	208/230-1	197	253	23.9	95.4	4.1	0.8	34.8	28.8	50	8	113
KLA142	510CE	208/230-3	187	253	15.3	82.0	5.6	1.0	25.8	21.9	35	10	108
KHA042	310BF	208/230-1	197	253	23.9	95.4	3.9	0.8	34.6	28.6	50	8	114
KHA042	510CF	208/230-3	187	253	15.3	82.0	5.0	1.0	25.2	21.3	35	10	111
KLA148	310BE	208/230-1	197	253	23.7	116.0	4.5	1.9	36.1	30.1	50	8	108
KLA148	510CE	208/230-3	187	253	14.7	92.0	7.8	2.2	28.4	24.7	35	10	96
KLA148	610CE	460-3	414	506	7.0	46.0	3.3	1.2	13.3	11.5	20	14	180
KHA048	310BF	208/230-1	197	253	23.7	116.0	3.7	1.9	35.3	29.3	50	8	111
KHA048	510CF	208/230-3	187	253	14.7	92.0	5.8	2.2	26.4	22.7	35	10	104
KLA160	310BE	230-1	207	253	27.8	130.0	6.2	1.9	42.9	35.9	60	8	100
KHA060	310BF	230-1	207	253	27.8	130.0	6.5	1.9	43.2	36.2	60	8	99

AWG—American Wire Gage

FLA —Full Load Amps

IFM —Indoor Fan Motor

LRA —Locked Rotor Amps

MCA —Maximum Circuit Ampacity

OFM —Outdoor Fan Motor

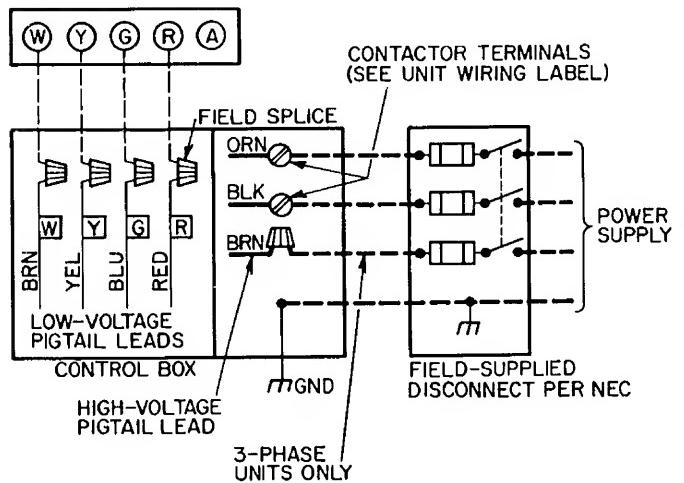
RLA —Rated Load Amps

*Voltage limits between which the unit will operate satisfactorily

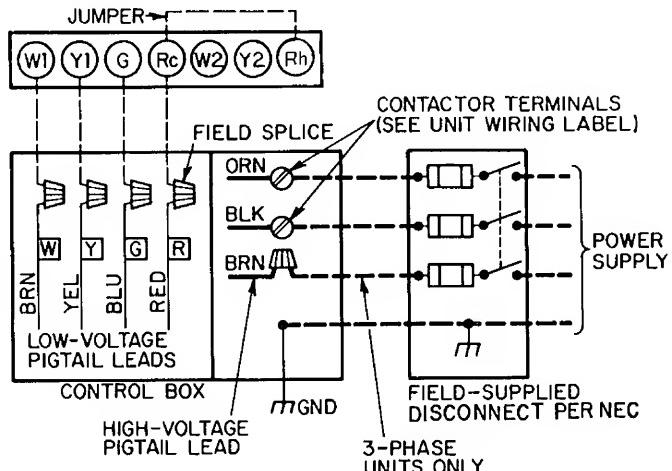
†If other than 75 C copper wire is used, determine size from unit ampacity and the National Electrical code. Voltage drop of wire must be less than 2% of unit rated voltage Maximum wire length is for one way along the wire path from unit to service panel

‡Maximum dual element size

SINGLE-STAGE HEAT & COOL- MANUAL CHANGEOVER



SINGLE-STAGE HEAT & COOL- AUTOCHANGEOVER



- Field Low-Voltage Wiring
- Field High-Voltage Wiring
- Factory Low-Voltage Wiring
- Factory High-Voltage Wiring

NOTE: For manual changeover applications, use thermostat part no. HH01AD042 with subbase part no. HH93AZ042, or thermostat part no. HH01AD040 with subbase part no. HH93AZ040

For automatic changeover, use thermostat part no. HH07AT174 with subbase part no. HH93AZ096; or thermostat part no. HH10AD041 with subbase part no. HH93AZ041.

Fig. 8—High- and Low-Voltage Connections

START-UP

Unit Preparation

⚠ WARNING

Failure to observe the following warnings could result in serious personal injury:

1. Follow recognized safety practices and wear protective goggles when checking or servicing refrigerant system.
2. Do not operate compressor or provide any electric power to unit unless compressor terminal cover is in place and secured.
3. Do not remove compressor terminal cover until all electrical sources have been disconnected.
4. Relieve all pressure from system before touching or disturbing anything inside terminal box if a refrigerant leak is suspected around compressor terminals.
5. Never attempt to repair a soldered connection while refrigerant system is under pressure.
6. *Do not use a torch* to remove any component. System contains oil and refrigerant under pressure. To remove a component, wear protective goggles and proceed as follows:
 - a. Shut off gas supply *first*, and *then* electrical power to unit.
 - b. Relieve all pressure from system.
 - c. Use tubing cutter to cut tubing that connects component, and remove component from unit.
 - d. Carefully unsweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

PRE-START-UP PROCEDURES—Proceed as follows to inspect and prepare unit for initial start-up:

1. Remove all access panels.
2. Read and follow instructions on all WARNING, CAUTION and INFORMATION labels attached to or shipped with the unit.
3. Make following inspections:
 - a. Inspect for shipping and handling damages such as broken lines, loose parts, disconnected wires, etc.
 - b. Inspect for oil at all refrigerant tubing connections and on unit base. The presence of oil generally indicates a refrigerant leak. Leak-test all refrigerant tubing connections using electronic leak detector, halide torch or liquid soap solution. If refrigerant leak is detected, see Refrigerant Leaks in next section.
 - c. Inspect all field- and factory-wiring connections. Be sure connections are completed and tight.
 - d. Inspect coil fins. If damaged during shipping and handling, carefully straighten fins with a fin comb.

⚠ WARNING

Do not purge gas supply into combustion chamber. Do not use a match or other open flame to check for gas leaks. Failure to adhere to this warning may cause an explosion.

4. Verify the following conditions:
 - a. Make sure gas supply has been purged, and all gas piping has been checked for leaks.
 - b. Make sure outdoor fan blade is correctly positioned in fan orifice. *Blades should clear fan motor by no more than $\frac{1}{4}$ inch.*

- c. Make sure air filter(s) is in place.
 - d. Make sure condensate drain pan is filled with water to ensure proper drainage.
 - e. Make sure all tools and miscellaneous loose parts have been removed.
5. Replace all access panels. Unit is now ready for initial start-up.

REFRIGERANT LEAKS—Proceed as follows to repair a refrigerant leak and to charge the unit.

⚠ WARNING

Never attempt to repair a soldered connection while refrigerant system is under pressure. Severe bodily injury may result. Always wear protective goggles when servicing the refrigerant system.

1. Locate leak and ensure that refrigerant system pressure has been relieved.
2. Repair leak following accepted practices.

NOTE: Install a filter drier whenever system has been opened for repair.

3. Add a small charge of R-22 refrigerant vapor to system and leak-test unit.
4. Evacuate refrigerant system if additional leaks are not found.
5. Charge unit with R-22 refrigerant, using a volumetric-charging cylinder, such as Dial-a-Charge, or accurate scale. Refer to unit rating plate for required charge. Be sure to add extra refrigerant to compensate for internal volume of filter drier.

NOTE: See Cooling Section Start-Up and Adjustments—Checking and Adjusting Refrigerant Charge.

Heating Section Start-Up and Adjustments

⚠ CAUTION

Complete required procedures given in Unit Preparation section before starting unit.

Do not jumper any safety devices when operating unit.

Ensure that burner orifices are properly aligned. Unstable operation may occur when the burner orifices in the manifold are misaligned. To ensure correct burner orifice alignment, check orifice angle with a machinist's protractor or other suitable device. The orifice angle must be from horizontal to 3 degrees down, as measured from unit base.

Follow instructions on heating section operation label (located in unit near the gas valve) or in Owner's Manual, to start the heating section.

CHECKING HEATING CONTROL OPERATION—Start and check unit for proper heating control operation as follows:

Place room thermostat selector switch in HEAT position and fan switch in AUTO. position. Set heating temperature control of thermostat above room temperature. Observe that after built-in time delays, the pilot automatically lights, burners light and blower motor starts. Observe that burners and pilot are extinguished, and that after a built-in delay, blower motor stops when heating control setting of thermostat is satisfied.

GAS INPUT

▲ CAUTION

These units are designed to consume the rated gas inputs using the fixed orifices at specified manifold pressures as shown in Table 4. DO NOT REDRILL ORIFICES UNDER ANY CIRCUMSTANCES.

The rated gas inputs shown in Table 4 are for altitudes from sea level up to 2000 ft above sea level. These inputs are based on natural gas with a heating value of 1050 Btu/cu ft at 0.65 specific gravity, or propane gas with a heating value of 2500 Btu/cu ft at 1.5 specific gravity. For elevations above 2000 ft, reduce input 4% for each 1000 ft above sea level. When gas supply being used has a different heating value or specific gravity, refer to Carrier training manuals, national and local codes, or contact your Carrier distributor or dealer to determine required orifice size.

ADJUSTING GAS INPUT—The gas input to unit is determined by measuring the gas flow at the meter or by measuring the manifold pressure. Measuring the gas flow at the meter is recommended for natural gas units. Manifold pressure must be measured to determine the input of propane gas units.

Measuring Gas Flow at Meter Method—Natural Gas Units—Minor adjustment can be made by changing manifold pressure. Manifold pressure must be maintained between 3.2 and 3.8 in. wg. If larger adjustments are required, change main burner orifices following recommendations of national and local codes.

NOTE: All other appliances that use the same meter must be turned off when gas flow is measured at meter.

Proceed as follows:

1. Turn off gas supply to unit.
2. Remove pipe plug on bottom of gas valve, then connect water manometer at this point. Turn on gas to unit.
3. Record number of seconds for gas meter test dial to make one revolution.
4. Divide number of seconds in step 3 into 3600 (number of seconds in one hour).
5. Multiply result of step 4 by the number of cu ft shown for one revolution of test dial to obtain cu ft of gas flow per hour.
6. Multiply result of step 5 by Btu heating value of gas to obtain total measured input in Btuh. Compare this

value with heating input shown in Table 4. Consult local gas supplier if the heating value of gas is not known.

Example: Assume that the size of test dial is one cu ft, one revolution takes 30 seconds and the heating value of the gas is 1050 Btu per cu ft, then proceed as follows:

- a. 30 seconds to complete one revolution.
- b. 30 divided into 3600 equals 120.
- c. 120 times one equals 120 cu ft of gas flow per hour.
- d. 120 times 1050 equals 126,000 Btuh input.

If the desired gas input is 125,000 Btuh, only a minor change in the manifold pressure is required.

Observe manifold pressure and proceed as follows to adjust gas input:

1. Remove cover screw over REG ADJ screw on gas valve.
2. Turn regulator adjustment screw clockwise to increase gas input, or turn regulator adjustment screw counterclockwise to decrease input. Manifold pressure must be between 3.2 and 3.8 in. wg. UNSAFE OPERATION OF THE UNIT MAY RESULT IF MANIFOLD PRESSURE IS OUTSIDE THIS RANGE.
3. Replace vented seal on gas valve.
4. Turn off gas supply to unit. Remove manometer from pressure tap. Replace pipe plug on gas valve. Turn on gas to unit. Check for leaks.

Measuring Manifold Pressure—Propane Gas Units—The main burner orifices on a propane gas unit are sized for the unit rated input when manifold pressure is 10.5 in. wg.

Proceed as follows to adjust gas input on propane gas unit:

1. Turn off gas to unit.
2. Remove pipe plug on gas valve outlet identified as PRESS. TAP, then connect manometer at this point.
3. Turn on gas to unit.
4. Remove cover screw over REG ADJ screw on gas valve.
5. Adjust regulator adjustment screw for a manifold pressure reading of 10.5 in. wg. Turn adjusting screw clockwise to increase manifold pressure, or turn adjusting screw counterclockwise to decrease manifold pressure.
6. Replace cover screw.
7. Turn off gas to unit. Remove manometer from pressure tap. Replace pipe plug on gas valve, then turn on gas to unit. Check for leaks.

Table 4—Rated Gas Inputs at Indicated Manifold Pressures

MODEL 48-	NUMBER OF ORIFICES	GAS SUPPLY PRESSURE (in. wg)				PRESSURE (in. wg)		NATURAL GAS		PROPANE GAS	
		Natural		Propane				Orifice Part No. (Size)	Heating Input (Btuh)*	Orifice Part No. (Size)	Heating Input (Btuh)*
		Min	Max	Min	Max	Natural	Propane				
KLA118,124,130	2	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB204(45)	40,000	LH32DB201(55)	40,000†
KLA136,142	3	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB205(45)	60,000	LH32DB201(55)	60,000†
KHA024,030	3	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB207(42)	75,000	LH32DB060(53)	75,000
KLA148	4	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB205(45)	80,000	LH32DB201(55)	80,000†
KHA136,KLA160	5	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB205(45)	100,000	LH32DB201(55)	100,000†
KHA036,042,048	5	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB207(42)	125,000	LH32DB060(53)	125,000
KHA060	6	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB207(42)	150,000	LH32DB060(53)	150,000

*Based on altitudes from sea level up to 2000 ft above sea level. For altitudes above 2000 ft, reduce input rating 4% for each 1000 ft above sea level.

†When KLA is converted to propane, all NOx burners must be modified. See kit instructions.

ADJUSTING BURNER AIR SHUTTERS—After burners have operated at full input for at least 10 minutes, adjust primary air to each burner to ensure optimum heating performance. Make these adjustments when unit is being installed and during routine maintenance inspections at beginning of each heating season. *Be sure each burner is clean and free of deposits before adjusting primary air.*

Primary air to each burner is regulated by burner air shutter on each burner. See Fig. 9 (Burner Flames, Standard) for location of burner air shutter. With all burners operating, adjust primary air to each burner as follows:

1. Loosen locking screw that secures air shutter in place on burner, then partially close air shutter until a slight yellow tip appears on top of burner flames.
2. Open air shutter *very slowly* until yellow tip just disappears, then secure air shutter in place with locking screw.
3. Repeat steps 1 and 2 for each burner.

After air shutter adjustments have been completed, observe that flames on each burner are light blue and soft in appearance, and that flames are same height along entire length of each burner. See Fig. 9.

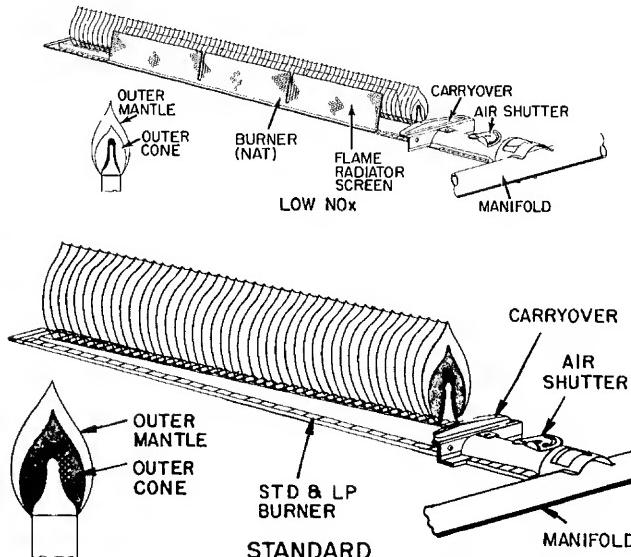


Fig. 9—Burner Flames

BLOWER HEAT-RELAY OPERATION—Heating relay (see Fig. 6 and unit wiring diagram) is located in the control box and adjusts to permit either longer or shorter OFF cycles. The ON cycle automatically adjusts as OFF cycle changes. Adjusting level on relay is factory-set at center position to provide optimum performance for most installations. On unusual installations, or where line voltage is considerably above or below rated voltage, an increase or decrease may be required for length of time blower remains on. To increase blower operation time, move adjusting lever toward right-hand position. To decrease blower operation time, move lever toward left-hand position.

AIRFLOW AND TEMPERATURE RISE—The heating section of each size of unit is designed and approved for heating operation within temperature rise range stamped on unit rating plate.

Table 5 shows approved temperature rise range for each unit and air delivery (cfm) at various temperature rises. Heating operation airflow must produce a temperature rise that falls within the approved range. Refer to Cooling Section Start-Up and Adjustments—Indoor Airflow and Airflow Adjustments to adjust heating airflow when required.

HEATING SEQUENCE OF OPERATION—See Fig. 10

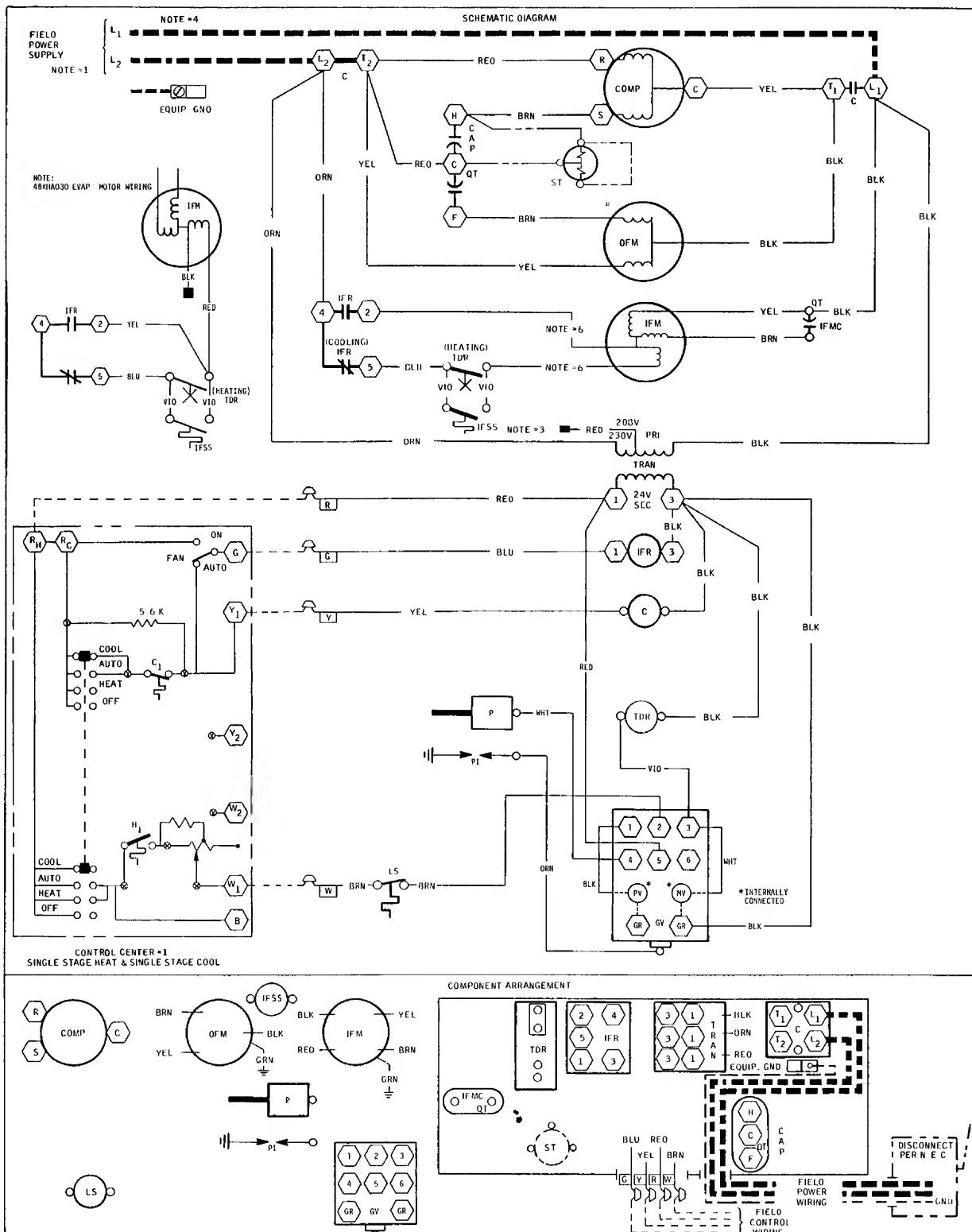
Models 48KHA,KLA have an intermittent electric-spark ignition system without a standing flame. When manual shutoff is opened, gas flows to gas valve. On a call for heating by the thermostat, unit terminal R makes to unit terminal W. Pilot valve solenoid of gas valve and spark generator are energized. Gas flows to pilot and the pilot is ignited within 4 seconds. The flame sensor proves the presence of pilot flame within 0.8 seconds after pilot ignition. The internal switching of gas valve de-energizes spark generator, energizes main valve solenoid and energizes heating delay relay. Gas flows to main burners and is ignited by pilot flame. Contacts of heating relay close between 60 and 90 seconds after burners are ignited, and blower motor starts. Heating cycle is now in normal operation. Unit will continue operating in heating cycle until thermostat is satisfied. When this occurs, the thermostat switching removes 24-volt control circuit voltage instantly; however, contacts of de-energized heating relay remain closed and keep blower motor running for an additional 2 to 3 minutes. Contacts of heating relay open after 2- to 3-minute delay and blower motor stops. Heating section is now in a standby condition waiting for another call for heating from thermostat.

→ Table 5—Air Delivery (cfm) at Indicated Temperature Rise and Rated Heating Input

MODEL 48-	HTG INPUT (Btu/h)	TEMPERATURE RISE (F)																				
		35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75
KLA118	40,000	794	751	712	678	646	617	591	567	545	524	505	487	471	455	441	427	—	—	—	—	
KLA124	40,000	794	751	712	678	646	617	591	567	545	—	—	—	—	—	—	—	—	—	—	—	
KHA024	75,000	—	—	—	—	1212	1158	1109	1063	1022	983	947	914	883	854	827	809	778	—	—	—	
KLA130	40,000	794	751	712	678	646	617	591	567	545	524	505	487	471	455	—	—	—	—	—	—	
KHA030	75,000	—	—	—	—	1271	1212	1158	1109	1063	1022	983	947	914	883	854	—	—	—	—	—	
KLA136	60,000	1190	1126	1068	1016	969	926	887	850	817	786	758	731	706	683	—	—	—	—	—	—	
KHA036/136	100,000	1984	1877	1781	1694	1615	1543	1478	1417	1362	1310	1263	1218	1177	1138	1102	1068	1036	1006	978	951	
KHA036	125,000	—	—	—	2117	2019	1930	1846	1771	1701	1638	1579	1523	1472	1423	1378	1336	1296	1258	1223	1189	1159
KLA142	60,000	1190	1128	1068	1016	969	926	887	850	817	786	758	731	706	683	661	641	622	604	587	571	556
KHA042	125,000	—	—	—	—	1930	1846	1771	1702	1638	1579	1523	1482	1423	1378	1326	1296	1258	1223	1189	—	
KLA148	80,000	1587	1502	1425	1355	1292	1235	1182	1134	1089	1048	1010	975	942	911	—	—	—	—	—	—	
KHA048	125,000	—	—	2326	2117	2019	1930	1846	1771	1702	1638	1579	1523	1472	1423	1378	1336	1296	—	—	—	
KLA160	100,000	1984	1877	1781	1694	1815	1543	1478	1417	1362	1310	1263	1218	1177	1138	1102	—	—	—	—	—	
KHA060	150,000	—	—	—	—	—	2325	2226	2135	2051	1974	1902	1835	1773	1715	1660	1609	1561	1516	1493	1483	1395

NOTE: Bolder ratings in table fall below the approved temperature rise range of the unit. Dashed areas of the table fall beyond the air delivery

capability of the unit within the operating voltage range for all voltage options for each size unit.



C — Contactor
Cap. — Capacitor
Comp. — Compressor
GV — Gas Valve
IFM — Indoor Fan Motor
IFMC — Indoor Fan Motor Capacitor
IFR — Indoor Fan Relay (Cooling)
IFSS — Indoor Fan Safety Switch
OFM — Outdoor Fan Motor
P — Pilot (Safety, Flame Sensing)
PI — Pilot Igniter
QT — Quadruple Terminal
ST — Start Thermistor
TDR — Time-Delay Relay (Adjustable) (Heating)
Tran — Transformer

— Wire Sleeve
 ○ Component Connection (Unmarked)
 ◻ Component Connection (Marked)
 - - - Field Wiring
 - - - Field Ground Wiring
 - - - Field Power Wiring
 ▲ Field Splice
 ● Junction
 ○ Junction (Thermostat to Subbase)
 - - - Alternate Start Thermistor Wiring

NOTES:

- 1 Use copper conductors only.
- 2 Compressor and fan motors thermally protected
- 3 Transformer pigtailed: red 208v; orange 230v; insulate unused lead
- 4 Neutral for 240/416-v system for Canada only
- 5 If any of the original wire furnished must be replaced, it should be replaced with wire of the same type or its equivalent
- 6 Fan motor pigtailed; red low, black high, insulate unused lead

Fig. 10—Typical Wiring Diagram (48KHA030310 shown)

**Table 6—Model 48KHA,KLA Air Delivery (cfm)*
at Indicated External Static Pressure and Voltage**

MODEL 48-	UNIT VOLTS— PHASE (60 Hz)	BLOWER MOTOR SPEED	COIL†	EXTERNAL STATIC PRESSURE (in. wg)																		
				208V								230V or 460V										
0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8					
KLA118	208- 230-1	Low	Heat# Cool‡	740 700	700 665	660 625	615 580	565 535	510 480	—	—	—	805 760	765 720	725 680	675 635	625 585	565 525	—	—		
		High	Heat# Cool‡	795 745	750 705	705 665	660 620	610 570	555 520	—	—	—	870 810	825 775	780 730	735 690	685 640	630 590	—	—		
KLA124	208- 230-1	Low	Heat# Cool‡	895 865	850 820	800 775	750 725	700 675	645 620	—	—	—	950 920	905 875	855 825	800 770	745 715	680 650	—	—		
		High	Heat# Cool‡	980 940	930 895	875 845	820 790	760 730	700 665	—	—	—	1030 985	975 935	920 885	865 835	810 780	755 725	—	—		
KHA024	208- 230-1	Low	Heat# Cool‡	995 935	925 900	890 870	855 835	815 800	780 766	—	—	—	1030 1000	990 965	955 935	920 890	880 860	840 820	—	—		
		High	Heat# Cool‡	1125 1080	1075 1035	1030 990	980 950	930 900	880 855	—	—	—	1160 1120	1115 1075	1065 1030	1015 980	965 935	915 885	—	—		
KLA130	208- 230-1	Low	Heat# Cool‡	700 690	680 670	655 650	635 630	610 605	585 580	—	—	—	850 835	820 810	795 785	765 755	735 725	705 695	—	—		
		High	Heat# Cool‡	1325 1270	1270 1220	1210 1165	1150 1110	1090 1045	1020 975	—	—	—	1370 1305	1310 1245	1245 1190	1180 1125	1110 1060	1035 990	—	—		
KHA030	208- 230-1	Low	Heat# Cool‡	1125 1085	1070 1035	1015 985	955 925	900 870	840 815	—	—	—	1175 1130	1115 1070	1050 1010	985 950	925 890	855 830	—	—		
		High	Heat# Cool‡	1225 1175	1165 1120	1105 1065	1040 1005	980 945	915 885	—	—	—	1260 1205	1200 1155	1140 1100	1080 1040	1020 985	955 925	—	—		
KLA136	208- 230-1	Low	Heat# Cool‡	950 945	945 940	940 935	930 925	915 910	900 890	—	—	—	1250 1210	1205 1165	1160 1080	1115 1035	1065 990	1015 990	—	—		
		High	Heat# Cool‡	1570 1475	1500 1410	1425 1345	1355 1275	1280 1205	1200 1140	—	—	—	1610 1510	1540 1450	1470 1390	1400 1325	1255 1260	1190	—	—		
KLA136	208/ 230-3	Low	Heat# Cool‡	1165 1155	1155 1145	1140 1125	1125 1110	1100 1085	1075 1050	1040 1015	995 960	930 855	1365 1345	1345 1320	1295 1265	1265 1235	1225 1190	1180 1135	1120 1060	1020 900		
		High	Heat# Cool‡	1525 1475	1490 1440	1450 1405	1415 1370	1375 1325	1330 1280	1280 1225	1135 1155	1045 1045	1620 1560	1580 1520	1540 1475	1495 1435	1450 1390	1405 1345	1355 1295	1300 1235	1155	
	460-3	Low	Heat# Cool‡	—	—	—	—	—	—	—	—	—	1185 1165	1175 1155	1160 1135	1135 1120	1110 1095	1095 1060	1060 1015	1005 970	940	
		High	Heat# Cool‡	—	—	—	—	—	—	—	—	—	1535 1485	1500 1450	1460 1415	1425 1380	1385 1335	1340 1290	1290 1235	1230 1165	1145 1055	
KHA036 KHA136	208- 230-1	Low	Heat# Cool‡	1280 1265	1260 1245	1240 1220	1215 1195	1190 1165	1160 1130	—	—	—	1510 1475	1480 1440	1445 1395	1400 1345	1280 1210	—	—	—		
		High	Heat# Cool‡	1825 1735	1765 1670	1700 1595	1630 1515	1540 1410	1425 1270	—	—	—	1905 1790	1845 1725	1775 1685	1700 1655	1595 1565	1475 1435	—	—	—	
KHA036 KHA136	208/ 230-3	Low	Heat# Cool‡	1275 1270	1270 1260	1260 1245	1240 1225	1220 1205	1195 1175	1165 1145	1135 1110	1100 1075	1505 1490	1490 1470	1445 1445	1415 1375	1375 1330	1330 1285	1280 1235	1185		
		Med	Heat# Cool	1625 1590	1605 1565	1575 1530	1540 1490	1500 1445	1455 1395	1400 1350	1350 1245	1295 1225	1845 1770	1805 1725	1760 1725	1655 1625	1595 1575	1535 1520	1480 1465	1415 1405	1350	
		High	Heat# Cool‡	2035 1915	1980 1860	1920 1800	1855 1765	1785 1610	1715 1545	1645 1480	1570 1410	1495 1395	2130 1995	2070 1940	2010 1875	1940 1745	1870 1680	1800 1615	1725 1545	1645 1475	1570	
KLA142	208- 230-1	Low	Heat# Cool‡	855 855	850 845	835 830	820 815	795 790	760 750	—	—	—	1035 1030	1025 1020	1010 1005	995 990	975 965	950 935	—	—	—	
		High	Heat# Cool‡	1700 1635	1635 1575	1565 1505	1495 1440	1425 1375	1355 1300	—	—	—	1770 1690	1705 1610	1635 1560	1555 1480	1470 1405	1385 1325	1375 1305	1330 1285	1185	
KHA042	208/ 230-3	Low	Heat# Cool‡	970 965	965 960	960 955	945 940	935 930	910 905	880 870	835 820	780 765	1190 1180	1185 1170	1175 1155	1165 1135	1145 1105	1120 1080	1080 1055	1020 990	940	
		High	Heat# Cool‡	2040 1950	1980 1890	1915 1835	1850 1770	1785 1705	1715 1635	1640 1555	1550 1465	1450 1380	2145 1830	2080 2030	2010 1970	1940 1840	1865 1770	1790 1695	1705 1610	1610 1515	1500 1400	
KHA042		Low	Heat# Cool‡	1410 1390	1385 1365	1365 1330	1315 1280	1255 1215	1175 1120	—	—	—	1580 1535	1530 1485	1475 1435	1420 1380	1360 1315	1290 1240	—	—	—	
		High	Heat# Cool‡	1705 1650	1650 1590	1525 1535	1495 1465	1425 1390	1365 1300	—	—	—	1770 1705	1710 1640	1645 1580	1575 1510	1500 1435	1475 1345	1385 1325	1355 1305	1330 1285	
KLA148	208/ 230-3	Low	Heat# Cool‡	1405 1400	1400 1395	1395 1370	1365 1345	1335 1310	1295 1260	1240 1205	1175 1145	1650 1510	1650 1440	1635 1415	1625 1405	1610 1395	1585 1385	1555 1365	1445 1350	1380 1320	1250	
		High	Heat# Cool‡	1725 1705	1710 1685	1685 1655	1615 1615	1565 1570	1505 1455	1440 1380	1370 1320	1305 1280	1935 1870	1885 1820	1835 1770	1800 1720	1730 1665	1670 1610	1610 1550	1545 1470	1445 1385	
KLA148		Low	Heat# Cool‡	1180 1175	1170 1165	1160 1155	1140 1130	1090 1075	980 960	—	—	—	1350 1345	1340 1325	1330 1300	1310 1255	1275 1225	1190 1120	—	—	—	
		High	Heat# Cool‡	1780 1770	1720 1710	1660 1645	1610 1590	1550 1525	1500 1470	—	—	—	1920 1860	1845 1790	1770 1725	1765 1700	1696 1655	1625 1585	1550 1515	—	—	—
KLA148	460-3	Low	Heat# Cool‡	1200 1195	1190 1190	1180 1180	1170 1170	1150 1145	1145 1140	1135 1130	1115 1110	1420 1415	1410 1405	1400 1395	1385 1385	1370 1370	1355 1355	1330 1330	1300 1285	1295 1260	1250	
		High	Heat# Cool‡	1805 1800	1800 1790	1785 1745	1765 1715	1735 1680	1700 1640	1665 1605	1625 1565	1585 1565	2080 2050	2050 2020	2015 1975	2020 1930	1970 1880	1865 1820	1805 1765	1745 1640	1680 1580	
KHA048	208- 230-1	Low	Heat# Cool‡	1690 1685	1650 1640	1600 1585	1545 1525	1480 1455	1420 1390	—	—	—	1790 1750	1730 1690	1665 1630	1600 1565	1530 1495	1450 1410	—	—	—	
		High	Heat# Cool‡	1890 1880	1820 1810	1760 1745	1690 1670	1625 1600	1560 1530	—	—	—	1975 1915	1900 1845	1820 1770	1745 1720	1665 1625	1590 1550	—	—	—	

(See next page for applicable notes)

**Table 6—Model 48KHA,KLA Air Delivery (cfm)*
at Indicated External Static Pressure and Voltage (cont)**

MODEL 48-	UNIT VOLTS— PHASE (60 Hz)	BLOWER MOTOR SPEED	COIL†	EXTERNAL STATIC PRESSURE (in. wg)								230V or 460V									
				208V								230V or 460V									
0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8				
KHA048	208/ 230-3	Low	Heat Cool	1440 1435	1435 1430	1425 1420	1415 1410	1400 1395	1385 1380	1365 1355	1340 1330	1305 1290	1730 1725	1720 1710	1700 1685	1675 1660	1645 1625	1601 1585	1560 1545	1520 1495	1470 1445
		Med	Heat Cool‡	1755 1745	1740 1730	1725 1710	1700 1680	1665 1645	1625 1600	1580 1550	1530 1500	1470 1440	1970 1950	1945 1920	1910 1880	1875 1840	1825 1790	1775 1735	1720 1685	1660 1625	1600 1570
		High	Heat Cool	1950 1925	1920 1890	1880 1850	1940 1810	1795 1765	1750 1715	1700 1665	1645 1615	1590 1560	2175 2130	2130 2085	2085 2035	2030 1980	1970 1920	1905 1855	1840 1790	1765 1720	1695 1650
KLA160	230-1	Low	Heat‡ Cool	— —	— —	— —	— —	— —	— —	— —	— —	— —	1610 1595	1600 1585	1580 1575	1560 1550	1530 1515	1495 1475	— —	— —	— —
		High	Heat Cool‡	— —	— —	— —	— —	— —	— —	— —	— —	— —	2375 2270	2280 2185	2185 2100	2095 2015	2000 1930	1905 1840	— —	— —	— —
		Low	Heat Cool	— —	— —	— —	— —	— —	— —	— —	— —	— —	1880 1875	1875 1865	1860 1840	1825 1790	1770 1725	1700 1650	— —	— —	— —
			Med	Heat‡ Cool	— —	2130 2075	2075 2025	2015 1965	1955 1900	1890 1835	1810 1760	— —	— —	— —							
			High	Heat Cool‡	— —	2345 2255	2260 2175	2180 2100	2095 2020	2010 1945	1930 1865	— —	— —	— —							

*Air delivery values are without air filter. Deduct field-supplied air filter pressure drop to obtain external static pressure available for ducting.

†Heating airflow values are with a dry coil. Cooling airflow values are with a wet coil.

‡These airflow values are at the factory heating and cooling motor speed setting.

A dash (—) indicates portions of the table that are beyond the blower motor capability or that are not applicable.

NOTE: Do not operate the unit at a cooling airflow that is less than 350 fpm per each 12,000 Btuh of rated cooling capacity. Indoor coil frosting may occur at airflows below this point.

NOTE: The igniter continues to spark for approximately 10 seconds after burners are ignited.

LIMIT AND PRESSURE SWITCHES—Furnace limit switch (see Fig. 10) closes gas valve if leaving-air temperature exceeds 175 F.

Normally closed limits switch completes control circuit through pigtail lead W to gas valve 5F. See Fig. 10. Should leaving-air temperature rise to 175 F, switch opens and W control circuit breaks. Any interruption in W control circuit instantly closes gas valve and stops gas flow to burners and pilot. Blower motor continues to run until time-delay sequence of heat relay is completed.

When air temperature at limit switch drops to the low-temperature setting of limit switch, switch closes and completes W control circuit. Electric-spark ignition system cycles and unit returns to normal heating operation.

BLOWER SAFETY SWITCH—Blower safety switch is a temperature-actuated switch connected in parallel with contacts of heat relay. Function of switch is to activate blower should gas valve fail to close when thermostat is satisfied. Safety switch is mounted on blower divider panel. When temperature at safety switch reaches approximately 175 F, switch closes to start blower. Switch opens when temperature at switch drops to approximately 116 F.

Cooling Section Start-Up and Adjustments

▲ CAUTION

Complete required procedures given in Unit Preparation section before starting unit.

Do not jumper any safety devices when operating unit.

Do not operate compressor when outdoor temperature is below 55 F (single-phase units) or 40 F (3-phase units).

Do not permit compressor to rapid cycle. Allow 5 minutes between cycles to prevent compressor damage.

CHECKING COOLING CONTROL OPERATION—Start and check unit for proper cooling control operation as follows:

1. Place room thermostat selector switch in OFF position. Observe that blower motor starts when fan switch is placed in ON position and shuts off when fan switch is placed in AUTO. position.
2. Place selector switch in COOL position and fan switch in AUTO. position. Set cooling control below room temperature. Observe that compressor, condenser fan and evaporator blower motors start. Observe that cooling cycle shuts down when control setting is satisfied.
3. When using an automatic changeover room thermostat, place both selector and fan switches in AUTO. positions. Observe that unit operates in heating mode when temperature control is set to call for heating (above room temperature) and operates in cooling mode when temperature control is set to call for cooling (below room temperature).

CHECKING AND ADJUSTING REFRIGERANT CHARGE—Refrigerant system is fully charged with R-22 refrigerant, tested and factory sealed. For most applications, factory charge is the correct amount for best performance; however, this charge may require a slight adjustment to attain rated performance.

NOTE: Adjustment of refrigerant charge is not required unless unit is suspected of not having proper R-22 charge. For all applications, correct R-22 charge for best performance is charge that results in a suction gas superheat of 5 F at compressor inlet when unit is operating at ARI rating conditions of 95 F db outdoor and 80 F db/67F wb indoor.

A superheat charging label is attached to outside of compressor access door. Label includes a Field Superheat Charging Table and a Required Suction-Tube (F) temperature chart.

Table 7 is intended for use when minor unit charge adjustments are required. For large adjustments, evacuate unit and weigh in charge according to unit rating plate. Use Table 7 to approximate charge if ARI rating conditions can-

not be obtained. Refer to required airflow rates in Table 8. Charge unit with outdoor fan operating only at high speed.

An accurate superheat-, thermocouple-, or thermistor-type thermometer, a sling psychrometer and a gage manifold are required when using superheat charging method for evaluating unit charge. *Do not use mercury or small dial-type thermometers because they are not adequate for this type of measurement.*

⚠ CAUTION

When evaluating refrigerant charge, an indicated adjustment to specified factory charge must always be minimal. If a substantial adjustment is indicated, an abnormal condition exists somewhere in cooling system, such as insufficient airflow across either or both coils.

Proceed as follows:

1. Remove caps from low- and high-pressure service fittings. See Fig. 4 for location of entrance for refrigerant pressure gage hoses.
2. Using hoses with valve core depressors, attach low- and high-pressure gage hoses to low- and high-pressure service fittings, respectively.
3. Start unit in cooling mode and let unit run until system pressures stabilize.
4. Measure and record the following:
 - a. Outdoor ambient-air temperature (F db).
 - b. Evaporator inlet-air temperature (F wb).
 - c. Suction-tube temperature (F) at low-side service fitting.
 - d. Suction (low-side) pressure (psig).
5. Using Field Superheat Charging Table, compare outdoor-air temperature (F db) with evaporator inlet-air temperature (F wb) to determine desired system operating superheat temperature.
6. Using Required Suction-Tube (F) table, compare desired superheat temperature with suction (low-side) operating pressure (psig) to determine proper suction tube temperature.
7. Compare actual suction-tube temperature with proper suction tube temperature. Using a tolerance of ± 3 F, add refrigerant if actual temperature is more than 3 F higher than proper suction tube temperature, or remove refrigerant if actual temperature is more than 3 F lower than required suction-tube temperature.

NOTE: If the problem causing inaccurate readings is a refrigerant leak, see Unit Preparation, Refrigerant Leaks section of these instructions.

INDOOR AIRFLOW AND ADJUSTMENTS

⚠ CAUTION

For cooling, recommended airflow is 350 to 450 cfm for each 12,000 Btu/h of rated cooling capacity. For heating, airflow must produce a temperature rise that falls within the range stamped on unit rating plate.

Models 48KHA,KLA end-discharge units have direct-drive blower motors. All motors are factory-connected to deliver proper heating and cooling airflows at normal external static pressures (except for some 208-v applications).

Table 7—Refrigerant Charging Label

DESIRED SUPERHEAT TEMPERATURE (F)
(Measured @ Low-Side Service Port)

OUTDOOR AMBIENT EDB (F)	EVAPORATOR AIR INLET EWB (F)											
	54	56	58	60	62	64	66	68	70	72	74	76
65	10	13	16	19	21	24	27	30	33	36	38	41
70	7	10	13	16	19	21	24	27	30	33	36	39
75	—	6	9	12	15	18	21	24	28	31	34	37
80	—	—	5	8	12	15	18	21	25	28	31	35
85	—	—	—	—	8	11	15	19	22	26	30	33
90	—	—	—	—	5	9	13	16	20	24	27	31
95	—	—	—	—	—	6	10	14	18	22	25	29
100	—	—	—	—	—	—	8	12	15	20	23	27
105	—	—	—	—	—	—	5	9	13	17	22	26
110	—	—	—	—	—	—	—	6	11	15	20	25
115	—	—	—	—	—	—	—	—	8	14	18	23

NOTES:

- 1 Dashed Areas: Do not attempt to charge system under these conditions or refrigerate slugging may occur
- 2 Add charge if actual superheat temperature is higher than chart value and remove if lower Allow ± 3 F for tolerance

**REQUIRED SUCTION-TUBE TEMPERATURE (F) vs.
DESIRED SUPERHEAT TEMPERATURE (F)
(Measured @ Low-Side Service Port)**

DESIRED SUPERHEAT TEMP (F)	SUCTION OR LOW-SIDE PRESSURE (Psig) AT SERVICE PORT								
	61.5	64.2	67.1	70	73	76	79.2	82.4	85.7
0	35	37	39	41	43	45	47	49	51
2	37	39	41	43	45	47	49	51	53
4	39	41	43	45	47	49	51	53	55
6	41	43	45	47	49	51	53	55	57
8	43	45	47	49	51	53	55	57	59
10	45	47	49	51	53	55	57	59	61
12	47	49	51	53	55	57	59	61	63
14	49	51	53	55	57	59	61	63	65
16	51	53	55	57	59	61	63	65	67
18	53	55	57	59	61	63	65	67	69
20	55	57	59	61	63	65	67	69	71
22	57	59	61	63	65	67	69	71	73
24	59	61	63	65	67	69	71	73	75
26	61	63	65	67	69	71	73	75	77
28	63	65	67	69	71	73	75	77	79
30	65	67	69	71	73	75	77	79	81
32	67	69	71	73	75	77	79	81	83
34	69	71	73	75	77	79	81	83	85
36	71	73	75	77	79	81	83	85	87
38	73	75	77	79	81	83	85	87	89
40	75	77	79	81	83	85	87	89	91

NOTE: Measure suction-tube temperature with an accurate superheat thermocouple, or thermistor-type thermometer.

Table 5 shows heating airflow at various temperature rises. Table 6 shows both heating and cooling airflows at various external static pressures for Models 48KHA,KLA direct-drive units. Refer to these tables to determine airflow for system being installed. See Table 8 for rated cooling and heating airflows.

NOTE: Be sure all supply- and return-air grilles are open, free from obstructions and adjusted properly.

⚠ WARNING

Disconnect electrical power to unit before changing blower speed. Be sure to turn off gas supply before disconnecting electrical power. Failure to do so may cause personal injury or death.

Table 8—Rated Cooling and Heating Airflows

MODEL 48-	COOLING		HEATING	
	Rated Airflow (cfm)*	ESP (in. wg)	Rated Airflow (cfm)*	Maximum ESP (in. wg)*
KLA118310BE	630	0.10	505	0.30
KLA124310BE	800	0.10	505	0.30
KHA024310BF	800	0.10	947	0.30
KLA130310BE	1000	0.15	462	0.30
KHA030310BF	1000	0.15	947	0.30
KLA136310BE	1200	0.15	758	0.30
KLA136510CE	1200	0.15	758	0.65
KLA136610CE	1200	0.15	758	0.65
KHA136310BE	1200	0.15	1155	0.30
KHA136510CE	1200	0.15	1155	0.65
KHA036310BF	1200	0.15	1445	0.30
KHA036510CF	1200	0.15	1445	0.65
KLA142310BE	1400	0.15	695	0.30
KLA142510CE	1400	0.15	695	0.65
KHA042310BF	1400	0.15	1445	0.30
KHA042510CF	1400	0.15	1445	0.65
KLA148310BE	1600	0.20	925	0.30
KLA148510CE	1600	0.20	925	0.65
KLA148610CE	1600	0.20	925	0.65
KHA048310BF	1600	0.20	1445	0.30
KHA048510CF	1600	0.20	1445	0.65
KLA160310BE	2000	0.20	1155	0.30
KHA060310BF	2000	0.20	1735	0.30

ESP—External Static Pressure

*Rated in accordance with U.S. Government D.O.E. test procedures and/or ARI Standard 210-81

NOTE: When operating the 208/230-volt, 3-phase versions of Model 48KHA048 at 208 volts, lead connections of blower motor must be changed as indicated on unit wiring label to ensure proper airflow.

! CAUTION

Do not change blower-motor lead connections on 460-v units from factory setting.

Heating and/or cooling airflow of 208/230-v direct-drive blower motors can be changed by changing the lead connections of blower motor. Motor leads are color-coded as follows:

- black—high speed
- blue—medium speed
- red—low speed

NOTE: Some direct-drive blower motors do not have lead for medium speed. Factory connections and available optional connections are shown in Table 6.

For all units, motor lead connected to heat relay determines heating speed and resulting airflow; and motor lead connected to cooling relay determines the cooling speed and resulting airflow. See unit wiring label.

To change heating and/or cooling speed, connect appropriate color-coded lead to appropriate relay. Be sure to properly insulate any unused motor lead. See Make Wiring Connections, Special Procedures for 208-v Operation section for proper procedures to insulate an unused electrical lead.

When installing a 208- or 230-v direct-drive unit that is factory-connected for heating and cooling speeds that are not the same, and same speed for both heating and cooling is required for a particular application, connect appropriate color-coded lead to terminal 2 of cooling relay and connect a field-supplied jumper between heat relay and terminal 2 of cooling relay. Be sure to properly insulate unused motor lead(s).

CONTROLS—All compressors have the following internal protection controls:

High-Pressure Relief Valve—This valve opens when pressure differential between low and high side becomes excessive.

Compressor Overload—This overload interrupts power to compressor when either current or internal temperature becomes excessive, and automatically resets when internal temperature drops to a safe level. This overload may require up to 60 minutes (or longer) to reset; therefore, if internal overload is suspected of being open, disconnect electrical power to unit and check circuit through overload with an ohmmeter or continuity tester.

COOLING SEQUENCE OF OPERATION—The following sequence of operation pertains to all 208/230-volt, 3-phase units; however, sequence of operation of single-phase and 460-volt units is very similar. Refer to wiring diagram in Fig. 10.

NOTE: Although actual unit wiring may vary slightly from that shown in Fig. 10, sequence of operation will not be affected.

With room thermostat selector switch in the COOL position and fan switch in AUTO. position, cooling sequence of operation is as follows:

When room temperature rises to a point slightly above cooling control setting of thermostat, thermostat cooling bulb tilts and completes circuit between thermostat terminal R to terminals Y and G. These completed circuits through the thermostat connect contactor coil (through unit wire Y) and relay coil (through unit wire G) across the 24-volt secondary of transformer.

The 2 sets of normally open contacts of energized contactor 2D close and complete circuit through compressor motor 3F and condenser fan motor 3D1. Both motors start instantly.

The set of normally open contacts of energized relay closes and completes circuit through evaporator blower motor. Blower motor starts instantly.

NOTE: Three-phase units are equipped with a 2-speed condenser fan motor and a temperature-actuated switch. Fan motor operates at high speed when outdoor temperature rises to 75 ± 3 F and continues to operate at high speed until outdoor temperature drops to 61 ± 4 F. At 61 F or lower, fan motor operates at low speed and permits cooling operation down to 40 F.

Cooling cycle remains on until room temperature drops to a point slightly below cooling control setting of room thermostat. At this point, thermostat cooling bulb tilts and breaks circuit between thermostat terminal R to terminals Y and G. These open circuits de-energize contactor coil and relay coil. Condenser, compressor and blower motors stop. Unit is in a standby condition, waiting for next call for cooling from room thermostat.

SERVICE

To ensure continuing high performance, and to minimize the possibility of premature equipment failure, periodic maintenance must be performed on this equipment. This combination heating/cooling unit should be inspected at least once a year by a qualified service person.

NOTE TO EQUIPMENT OWNER: Consult your local dealer about the availability of a maintenance contract.

⚠ WARNING

The ability to properly perform maintenance on this equipment requires certain expertise, mechanical skills, tools and equipment. If you do not possess these, do not attempt to perform any maintenance on this equipment other than those procedures recommended in the Owner's Manual. FAILURE TO HEED THIS WARNING COULD RESULT IN SERIOUS PERSONAL INJURY AND EQUIPMENT DAMAGE.

The minimum maintenance requirements for this equipment are as follows:

1. Inspect air filter(s) each month. Clean or replace when necessary.
2. Inspect cooling coil, drain pan, and condensate drain each cooling season for cleanliness. Clean when necessary.
3. Inspect blower motor and wheel for cleanliness and check lubrication each heating and cooling season. Service when necessary.
4. Check electrical connections for tightness and controls for proper operation each heating and cooling season. Service when necessary.
5. Check and inspect heating section before each heating season. Clean and adjust when necessary.

⚠ WARNING

Failure to follow these warnings could result in serious personal injury.

1. Turn off gas supply, *then disconnect electrical power to unit before performing any maintenance or service.*
2. Use extreme caution when removing panels and parts. As with any mechanical equipment, personal injury can result from sharp edges, etc.
3. Never place anything combustible either on, or in contact with unit.
4. Should overheating occur, or gas supply fail to shut off, *first* shut off external main manual gas valve to unit, *then* shut off electrical supply.

Top Removal

⚠ CAUTION

When removing unit top, use extreme caution to protect seal that isolates heat exchanger and flue products from other sections. Removal of top must never be attempted by anyone other than qualified technicians.

⚠ CAUTION

Condenser fan and motor are fastened to unit top. When removing top, use extreme care not to pull fan motor leads loose.

NOTE: When performing maintenance or service procedures that require removal of unit top, be sure to perform *all* routine maintenance procedures that require top removal, including: inspection of heat exchanger area, coil inspection and cleaning, and condensate drain pan inspection and cleaning.

When performing maintenance and service procedures that require unit top removal, refer to following top removal procedures:

1. Turn off gas supply, *then* disconnect electric power to unit.
2. Remove vent cap and combustion-air assemblies. Do not damage gasket. Refer to Venting section and reverse assembly procedures shown.
3. Remove all screws that secure unit top, including screws around 4 sides and those on top that screw into internal divider panels. Save all screws.
4. Tape all side panels at each seam near unit top. Use tape strips that are at least 5 in. long to prevent sides from falling when top is removed.
5. Carefully lift top from unit. Set top on edge and ensure that it is supported by unit side that is opposite duct (or plenum) side. *Use extreme care to prevent damage to either seal that isolates heat exchanger and flue products, or the fan blades, motor and insulation.*

⚠ WARNING

If seal that isolates heat exchanger and flue products is damaged, repair seal, using same type of foil-backed insulation used at time of manufacture, and/or aluminum duct tape, depending on severity of damage. FAILURE TO HEED THIS WARNING COULD RESULT IN SERIOUS PERSONAL INJURY TO OCCUPANTS OF THE CONDITIONED SPACE.

6. Carefully replace and secure unit top to unit, using screws removed in step 3 when maintenance and/or service procedures are concluded. Be sure to use original screws that have rubber washers to seal out water when securing top to internal divider panels.
7. Reinstall vent cap and combustion-air assemblies. Refer to Venting section.

Air Filter

⚠ CAUTION

Never operate unit without a suitable air filter in return-air duct system. Always replace filter with same size and type. See Table 2 for filter sizes.

Inspect field-supplied air filter(s) at least once each month and replace (disposable type) or clean (cleanable type) at least twice during each heating and cooling season or whenever the filter(s) becomes clogged with dust and lint.

Evaporator Blower Wheel and Motor—For longer life, operating economy and continuing efficiency, clean accumulated dirt and grease from blower wheel and motor annually.

Lubricate motor every 5 years if motor is used intermittently (thermostat FAN switch in AUTO. position), or every 2 years if motor is used continuously (thermostat FAN switch in ON position).

⚠ WARNING

Turn off gas supply, *then* disconnect and tag electrical power to unit before cleaning and lubricating blower motor and wheel. Failure to do so may cause personal injury or death.

Clean and lubricate blower motor and wheel as follows:

1. Remove and disassemble blower assembly.

- a. Remove blower and control access panels.
 - b. Refer to unit wiring label and disconnect blower motor leads from their termination points in unit control box. Be sure to mark wiring label appropriately if lead terminations were not previously marked. Pull leads into blower compartment.
 - c. Remove blower assembly from unit. Be careful not to tear insulation in blower compartment.
 - d. Ensure proper reassembly by marking blower wheel and motor in relation to blower housing before disassembly.
 - e. Loosen setscrew(s) that secures wheel to motor shaft, remove screws that secure motor mount brackets to housing, and slide motor and motor mount out of housing.
2. Lubricate motor.
- a. Thoroughly clean all accumulations of dirt or grease from motor housing.
 - b. Remove dust caps or plugs from oil ports located at each end of motor.
 - c. Use a good grade of SAE 20 nondetergent motor oil and put one teaspoon, 5 cc, $\frac{1}{16}$ oz., or 16 to 25 drops in each oil port.
 - d. Allow time for oil to be absorbed by each bearing, then wipe excess oil from motor housing.
 - e. Replace dust caps or plugs in oil ports.
3. Remove and clean blower wheel.
- a. Ensure proper reassembly by marking wheel orientation and cutoff plate location.
 - b. Remove screws holding cutoff plate, and remove plate from housing.
 - c. Lift wheel from housing. When handling and/or cleaning blower wheel, be sure not to disturb balance weights (clips) on blower wheel vanes.
 - d. Remove caked-on dirt from wheel and housing with a brush. Remove lint and/or dirt accumulation from wheel and housing with vacuum cleaner, using soft brush attachment. Remove grease and oil with mild solvent.
 - e. Reassemble wheel and cutoff plate into housing.
 - f. Reassemble motor into housing. Be sure setscrews are tightened on motor shaft flats and not on round part of shaft.
4. Reinstall blower assembly into unit. Route blower motor leads into control compartment and reconnect all blower motor leads to proper termination points in unit control box. Replace panels.
5. Restore electrical power, *then* gas supply, to unit. Start unit and check for proper blower rotation and motor speeds during heating and cooling cycles.

Heating Section—Ensure dependable and efficient heating operation by inspecting heating section before each heating season and cleaning when necessary. Proceed as follows:

1. Turn off gas supply, *then* disconnect electrical power to unit.
2. Inspect and clean heating section.
 - a. Remove control access door.
 - b. Remove unit top following procedures under Top Removal.
 - c. Remove secondary-air shield, flue baffles, pilot and burners. Flue baffles may be removed after partial loosening of collector front panel. Inspect and clean all of these components. Be sure to remove any residue that may have collected on a component.

- d. Clean flue ways with brush and/or vacuum, and inspect heat exchanger for leaks and cracks.
 - e. Inspect indoor-air passages in unit for cleanliness and check tightness of screws and parts.
 - f. Replace all components removed in step c, and replace unit top.
3. Restore electrical power, *then* gas supply to unit. Start heating cycle and adjust burner air shutters. See Heating Section Start-Up and Adjustments—Adjusting Burner Air Shutters.

⚠ WARNING

Never use a match or other flame to check for gas leaks. Failure to adhere to this warning may cause an explosion.

4. Inspect gas control area for gas leaks, using a soap-and-water solution.
5. Replace control access panel.

Pilot—Inspect the pilot and clean (when necessary) at beginning of each heating season. Remove accumulation of soot and carbon from pilot. The pilot flame must be high enough to properly touch flame-sensing element and to light burners.

Condenser Coil, Evaporator Coil and Condensate Drain Pan—Inspect condenser coil, evaporator coil and condensate drain pan at least once each year. Proper inspection and cleaning requires removal of unit top. See Top Removal section.

Coils are easily cleaned when dry; therefore, inspect and clean coils either before or after each cooling season. Remove all obstructions including weeds and shrubs that interfere with airflow through condenser coil. Straighten bent fins with a fin comb. If coated with dirt or lint, clean coils with a vacuum cleaner, using soft brush attachment. Be careful not to bend fins. If coated with oil or grease, clean coils with mild detergent and water solution. Rinse coils with clear water, using a garden hose. Be careful not to splash water on motors, insulation, wiring or air filter(s). For best results, spray condenser coil fins from inside to outside of unit. On units with an outer and inner condenser coil, be sure to clean between coils. Be sure to flush all dirt and debris from unit base.

Inspect drain pan and condensate drain line when inspecting the coils. Clean drain pan and condensate drain by removing all foreign matter from pan. Flush pan and drain tube with clear water. Do not splash water on insulation, motor, wiring or air filter(s). If drain tube is restricted, clear it with a plumber's snake or similar probe device.

The bottom of drain tube has a $\frac{1}{8}$ -in. diameter hole. This hole is located in the portion of the drain tube that runs through drain pan. Clean this hole with a stiff wire that has a $\frac{3}{8}$ -in. long, 90 degree bend.

Condenser Fan

⚠ CAUTION

Keep condenser fan free of all obstructions to ensure proper cooling operation. Never place articles on top of unit.

Inspect fan blades for cracks or bends each year. Ensure that blades clear the motor by exactly $\frac{1}{4}$ inch. If blade assembly has slipped down motor shaft, adjust fan position

on motor shaft by loosening setscrew(s), then moving blade assembly up. Be sure setscrew(s) is on flat(s) of shaft before tightening.

Electrical Controls and Wiring—Inspect and check electrical controls and wiring annually. *Be sure to turn off gas supply and then electrical power to unit.*

Remove control, blower and compressor compartment access panels to locate all electrical controls and wiring. Check all electrical connections for tightness. Tighten all screw connections. If any smoky or burned connections are noticed: disassemble the connection, clean all parts, restrip wire end and reassemble connection properly and securely.

After inspecting electrical controls and wiring, replace all panels. Start unit and observe at least one complete heating cycle and one complete cooling cycle to ensure proper operation. If discrepancies are observed in either or both operating cycles, or if a suspected malfunction has occurred, check each electrical component with proper electrical instrumentation. Refer to unit wiring label when making these checkouts.

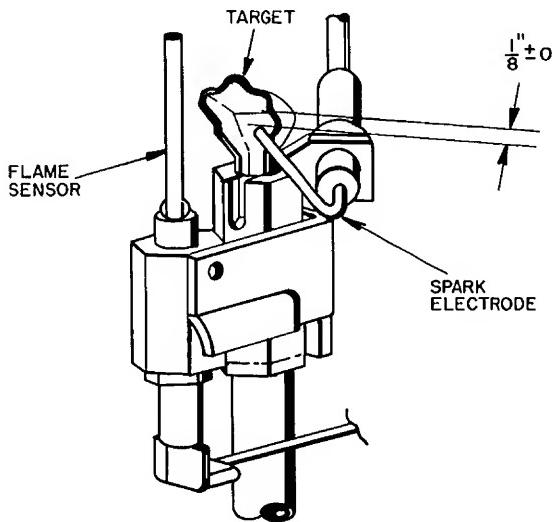


Fig. 11—Position of Electrode to Pilot

NOTE: Refer to heating and/or cooling sequence of operation in this publication as an aid in determining proper control operation.

Refrigerant Circuit—Annually inspect all refrigerant tubing connections and unit base for oil accumulations. Presence of oil generally indicates a refrigerant leak.

If oil is detected or if low-cooling performance is suspected, leak-test all refrigerant tubing using an electronic leak detector, halide torch, or liquid-soap solution. If a refrigerant leak is detected, see Unit Preparation—Refrigerant Leaks.

If no refrigerant leaks are found and low-cooling performance is suspected, see Cooling Section Start-Up and Adjustments—Checking and Adjusting Refrigerant Charge section.

Gas Input—Gas input does not require checking unless improper heating performance is suspected. If a problem exists, refer to Heating Section Start-Up and Adjustments section.

Evaporator Airflow—Heating and/or cooling airflow does not require checking unless improper performance is suspected. *If a problem exists, be sure all supply- and return-air grilles are open and free from obstructions, and air filter is clean.* When necessary, refer to Cooling Section Start-Up and Adjustments Indoor Airflow and Airflow Adjustments section to check system airflow.

TROUBLESHOOTING CHART
Table 9—Heating Service Analysis Chart

SYMPTOM	PROBABLE CAUSE	REMEDY
Pilot will not light	No spark at electrode	Check air gap between electrode tip and pilot burner Gap should be as shown in Fig. 11. Readjust as necessary. Clean moisture or dirt accumulation on electrode ceramic with cloth. Cracked ceramic—replace pilot electrode assembly. Check for loose or broken wiring at and between spark generator and electrode. Replace wire or tighten connection as necessary. Check fuses or circuit breaker to ensure voltage to unit. Check 24-volt input to spark generator. If reading is 24 volts, and above steps have been completed, replace electronic control head portion of control head/gas valve assembly.
	Spark shorting out to main burner	Realign electrode tip away from main burner but maintain spark gap to pilot burner. See Fig. 11.
	No gas at pilot burner	Clean pilot orifice. Check for 24 volts between terminals no. 1 and GR of gas valve. If reading is 24 volts, and above steps have been completed, replace gas valve portion of control head/gas valve assembly.
Burners will not ignite	Water in gas line	Drain—install water trap.
	No power to furnace	Check power supply, fuses, wiring, or circuit breaker.
	No 24-volt power supply to control circuit	Check transformer—replace if necessary.
	Miswired or loose connections	Check all wiring and wrenut connections.
	Dirty pilot—yellow flame	Clean pilot orifice.
	Pilot burning improperly—sharp blue flame	Replace pilot
	Burned-out heat anticipator in thermostat	Replace thermostat.
Inadequate heating	No gas at main burners	1. Check for 24 volts between terminals 3 and GR on control head If reading is 24 volts, replace gas valve portion of control head/gas valve assembly 2. If reading is not 24 volts, check flame sensor for cracked ceramic insulator or shorted sensor cable Replace electronic head if sensor circuit is not defective.
	Broken thermostat wire	Run continuity check to locate break.
	Dirty air filter	Clean or replace filter as necessary.
	Gas input to furnace too low	Check gas pressure at manifold Clock gas meter for input If too low, increase manifold pressure, or replace with correct orifices.
	Unit undersized for application	Replace with proper unit—or add additional unit.
	Restricted airflow	Clean or replace filter—or remove any restriction.
	Blower speed too low	Use faster speed tap—or install optional blower.
Poor flame characteristics	Incomplete combustion results in: Aldehyde odors, (CO), sooting flame—floating flame	Air shutters on burners closed—adjust to soft blue flame.
		Check all screws around flue outlets and burner compartment—tighten.
		Lack of combustion air. See Installation section.
		Cracked heat exchanger—replace.
		Overfired furnace—reduce input, or change orifices.
		Check vent for restriction—clean as required.
		Check orifice to burner alignment.

TROUBLESHOOTING CHART
Table 10—Cooling Service Analysis Chart

SYMPTOM	PROBABLE CAUSE	REMEDY
Compressor and condenser fan will not start	Power failure	Call power company.
	Fuse blown or circuit breaker tripped	Replace fuse or reset circuit breaker.
	Defective thermostat, contactor, transformer, or control relay	Replace component
	Insufficient line voltage	Determine cause and correct.
	Incorrect or faulty wiring	Check wiring diagram and rewire correctly.
	Thermostat setting too high	Lower thermostat setting below room temperature.
Compressor will not start but condenser fan runs	Faulty wiring or loose connections in compressor circuit	Check wiring and repair or replace.
	Compressor motor burned out, seized, or internal overload open	Determine cause Replace compressor.
	Defective run/start capacitor, overload, start relay	Determine cause and replace.
	One leg of 3-phase power dead	Determine cause. Replace fuse or reset circuit breaker.
Compressor cycle (other than normally satisfying thermostat)	Refrigerant overcharge or undercharge	Blow refrigerant, evacuate system, and recharge to nameplate.
	Defective compressor	Determine cause, replace.
	Insufficient line voltage	Determine cause and correct.
	Blocked condenser	Determine cause and correct.
	Defective run/start capacitor, overload, or start relay	Determine cause and replace.
	Defective thermostat	Replace thermostat.
Compressor operates continuously	Faulty condenser fan motor or capacitor	Replace.
	Restriction in refrigerant system	Locate restriction and remove.
	Dirty air filter	Replace filter.
	Unit undersized for load	Decrease load or increase unit size.
	Thermostat set too low	Reset thermostat.
	Low refrigerant charge	Locate leak, repair, and recharge.
Excessive head pressure	Leaking valves in compressor	Replace compressor.
	Air in system	Blow refrigerant, evacuate system, and recharge.
	Condenser coil dirty or restricted	Clean coil or remove restriction.
	Dirty air filter	Replace filter.
	Dirty condenser coil	Clean coil.
	Refrigerant overcharged	Purge excess refrigerant.
Head pressure too low	Air in system	Blow refrigerant, evacuate system, and recharge.
	Condenser air restricted or air short-cycling	Determine cause and correct.
	Low refrigerant charge	Check for leaks, repair, and recharge.
Excessive suction pressure	Compressor valves leaking	Replace compressor.
	Restriction in liquid tube	Remove restriction.
	High heat load	Check for source and eliminate.
Suction pressure too low	Compressor valves leaking	Replace compressor.
	Refrigerant overcharged	Purge excess refrigerant.
	Dirty air filter	Replace filter.
	Low refrigerant charge	Check for leaks, repair, and recharge.
	Metering device or low side restricted	Remove source of restriction.
	Insufficient evaporator airflow	Increase air quantity. Check filter—replace if necessary.
	Temperature too low in conditioned area	Reset thermostat.
	Outdoor ambient below 55 F	Install accessory low-ambient kit.
	Field-installed filter drier restricted	Replace.

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